

**Unique Identification Authority of India**  
Planning Commission  
Government of India

## **Report on**

# **Joint Field Test of Aadhaar Authentication**

## **with CRIS on moving Trains**

**Version 1.0**

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## 1 Introduction

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During the meeting of officials from Railway Board, CRIS, IRTCTC and UIDAI on 13-Jan-14 under the chairmanship of Shri Devi Pandey, Member (Traffic), necessity of an effective tool was felt which can prevent misuse of tickets through impersonation. It was discussed that a tool may be devised which can verify passengers at the time of booking tickets or onboard the train.

UIDAI officials suggested that the passengers can be effectively verified by means of Aadhaar biometric authentication onboard the train if the HHTs (Handheld Terminals) carried by the TTEs are enabled to perform Aadhaar online authentication. A possible approach could start with capturing Aadhaar number of one or more passengers, travelling on one ticket, at the time of booking tickets which can be biometrically verified online by the TTE using HHT.

In principle, all participants agreed to the suggested approach however a need for conducting field pilot was felt owing to two reasons: firstly, there is a possibility of failure of Aadhaar online authentication as GPRS network may not be available in all location, secondly, during switching of mobile phone towers at high speeds it is likely that data connectivity gets disrupted.

In view of the above, UIDAI along with CRIS planned for a joint field test onboard Shatabdi Expresses on three routes viz. New Delhi – Ajmer, New Delhi – Bhopal and New Delhi - Dehradun. UIDAI team was represented by PMU members while CRIS team was represented by Manager level officers. Following section contain detailed analysis of outcome of the field test.

*Note: In this document test routes have been identified with their station codes. New Delhi has been referred as NDLS, Ajmer as AJM, Bhopal as BPL and Dehradun as DDN.*

## 2 Test Preparation and Approach

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UIDAI engaged three device manufacturers for application development and device configuration but one device manufacturer later backed out owing to lack of their preparedness. Vodafone was engaged as both AUA (Authentication User Agency) and ASA (Authentication Service Agency). During the month of February '14 application development and integration with Vodafone's AUA & ASA infrastructure was carried out after which dates for field test, as stated in previous section, were decided along with CRIS.

It was envisaged that during the field test, biometric authentication will be carried out throughout the journey at an interval of one minute or less with the objective of capturing as many data points as possible for analysis. Along with biometric authentication, mobile network (dB) strength will also be captured at an interval of one minute for suitable mapping of total time of authentication with the network strength at that moment of time. The data thus captured will establish a correlation between the authentication response time and network strength.

### 3 Device Specifications

Sl. No.	Specification	Value
1.	Form factor	1. 7" Tablet PC (2 nos) 2. 5" Mobile phone (1 no)
3.	Operating System	Android 4.2.2
4.	Biometric Sensor	STQC Certified
5.	Application	Java on Android
6.	Network Connectivity	GPRS/ EDGE using Vodafone SIM having Roaming facility

AUA and ASA servers were provisioned by Vodafone for PoC purposes.

### 4 Test Results

Sl. No.	Item	Value
1.	Total number of successful authentication transactions performed on NDLS-AII-NDLS route	1,061
2.	Total number of successful authentication transactions performed on NDLS-BPL-NDLS route	1,497
3.	Total number of successful authentication transactions performed on NDLS-DDN-NDLS route	1,479
4.	Transactions ignored owing to issue with AUA server on NDLS-AII-NDLS route between 0900 hrs and 1705 hrs	180
5.	Total number of successful authentication transactions performed (1+2+3)	4,037
6.	Unsuccessful Transactions (No response received from server)	280 (6.48%)
7.	Minimum response time	< 1 sec
8.	Maximum response time	613 sec
9.	Minimum network strength	-111 dBm
10.	Maximum network strength	-51 dBm

## 5 Detailed Analysis of Test Result

As per the plan, joint field trials were carried out on the Shatabdi Expresses on the three routes earmarked viz. NDLS – AII – NDLS on 12-Mar-14, NDLS – BPL – NDLS on 13-Mar-14 and NDLS – DDN – NDLS on 14-Mar-14

### 5.1 Overall Response Time Analysis (for all three routes)

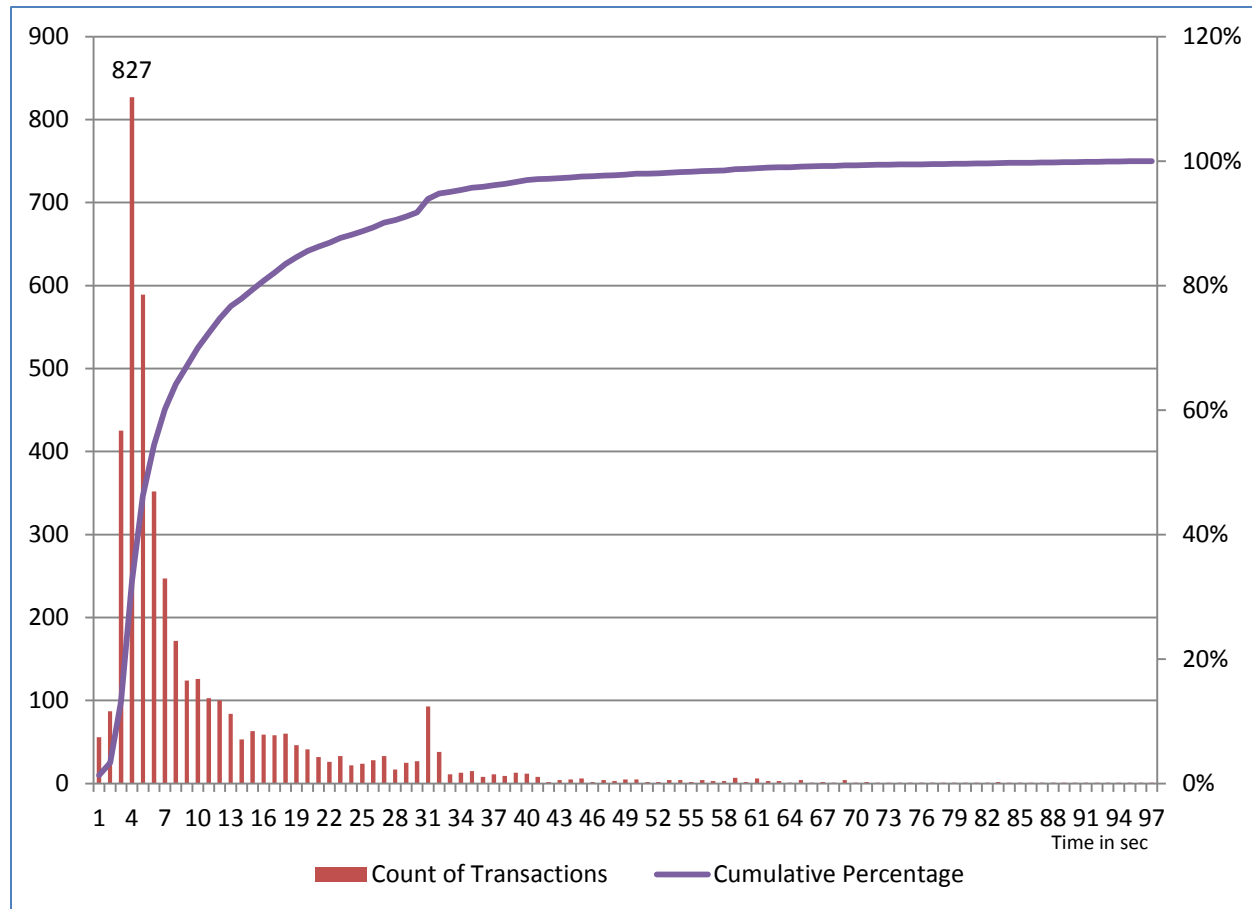


Figure 1: Overall Response Time Chart

#### Observations:

1. 50% transactions executed within 5 seconds
2. 75% transactions executed within 11 seconds
3. 85% transactions executed within 18 seconds
4. 95% transactions executed within 31 seconds
5. 49 records, approximately 1% of total load, took more than 60 seconds to execute.
6. Maximum execution time was 613 seconds on 12<sup>th</sup> March, 180 seconds on 13<sup>th</sup> March and 118 seconds on 14<sup>th</sup> March.

## 5.2 Response Time Analysis on New Delhi – Ajmer - New Delhi route

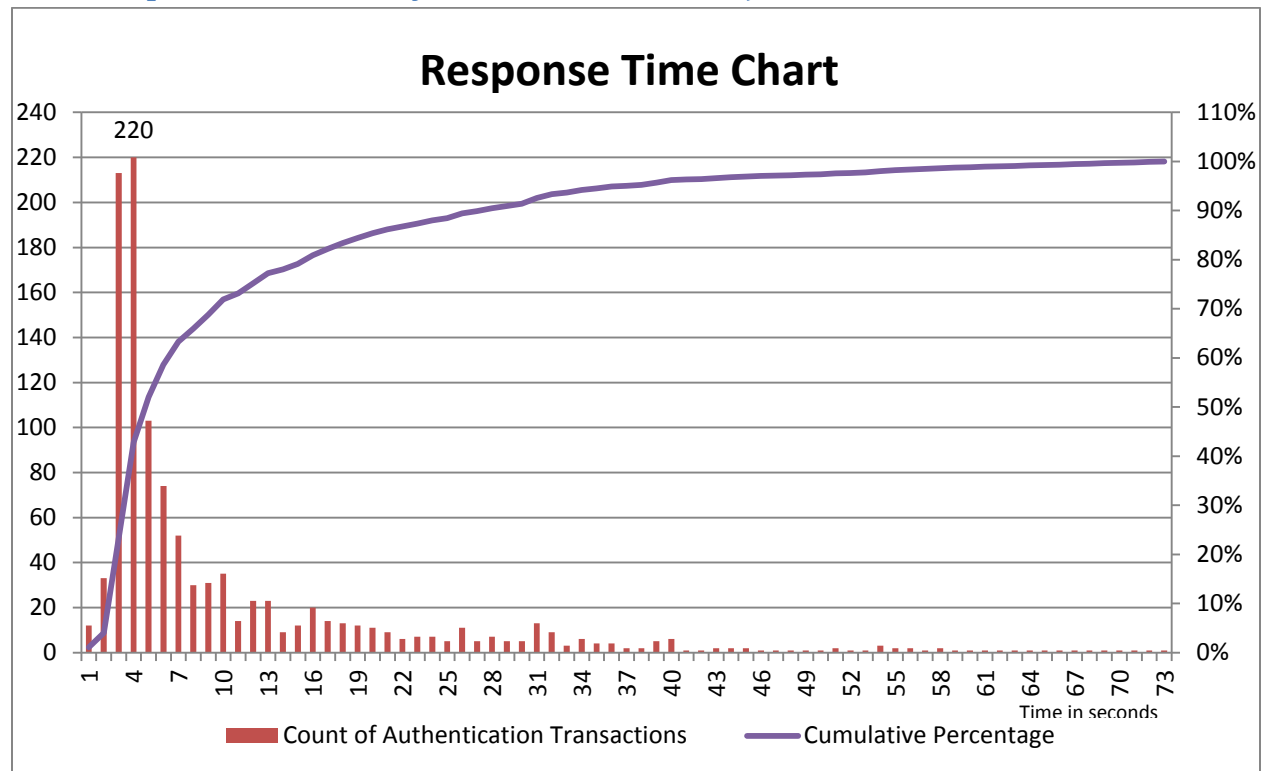


Figure 2: Response Time Chart for NDLS-AII-NDLS route

### Observations:

1. 50% transactions executed within 4 seconds
2. 75% transactions executed within 11 seconds
3. 85% transactions executed within 19 seconds
4. 95% transactions executed within 37 seconds
5. Small spike in number of authentication at 31 seconds

### Issue:

1. Vodafone's AUA server experienced outage between 8.59 am and 5.05 pm owing to memory leak. As a result of this issue, all 180 authentication transactions executed during this period have been excluded from analysis.

### 5.3 Response Time Analysis on New Delhi – Bhopal – New Delhi Route

A new AUA server was used on 13<sup>th</sup> March which had superior configuration as a result no outage was experience throughout the day. It was also observed that the response improved marginally when compared with the response time on 12<sup>th</sup> March.

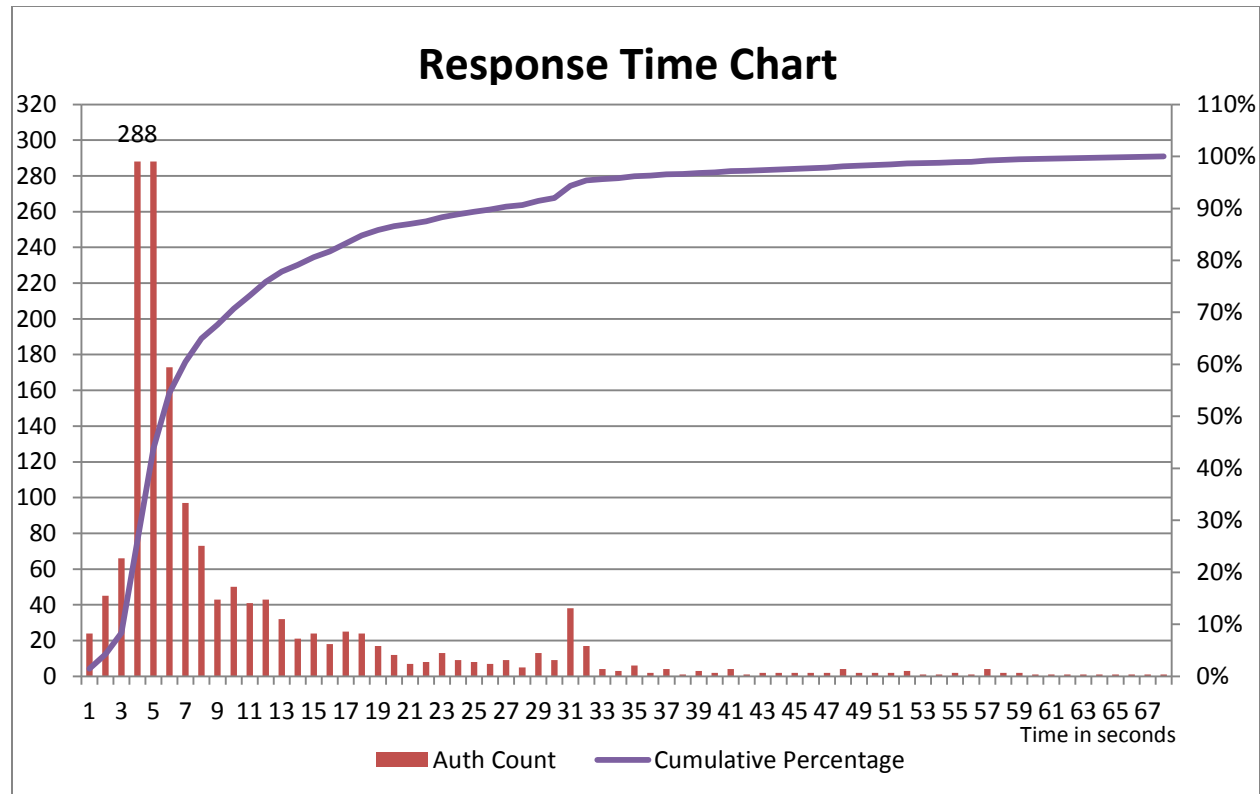


Figure 3: Response Time Chart for NDLS-BPL-NDLS Route

#### Observations:

1. 50% transactions executed within 5 seconds
2. 75% transactions executed within 11 seconds
3. 85% transactions executed within 17 seconds
4. 95% transactions executed within 31 seconds
5. Small spike in number of authentication at 31 seconds

## 5.4 Response Time Analysis on New Delhi – Dehradun – New Delhi route

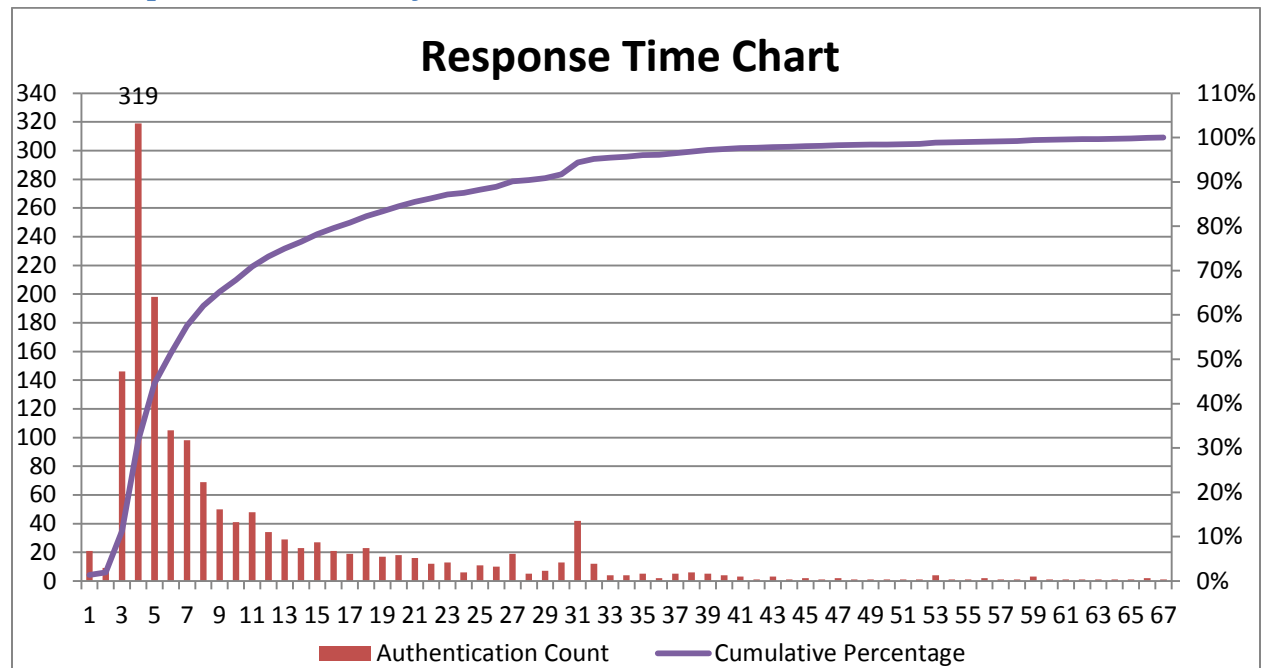


Figure 4: Response Time Chart for NDLS-DDN-NDLS Route

### Observations:

1. 50% transactions executed within 5 seconds
2. 75% transactions executed within 12 seconds
3. 85% transactions executed within 19 seconds
4. 95% transactions executed within 31 seconds
5. Small spike in number of authentication at 31 seconds



## 5.5 Regression Analysis of Network Strength vis-à-vis Authentication Response Time

In the chart below, regression analysis of network strength vis-à-vis authentication response time has been carried out. Network strength has been treated as independent variable while authentication response time has been treated as dependent variable.

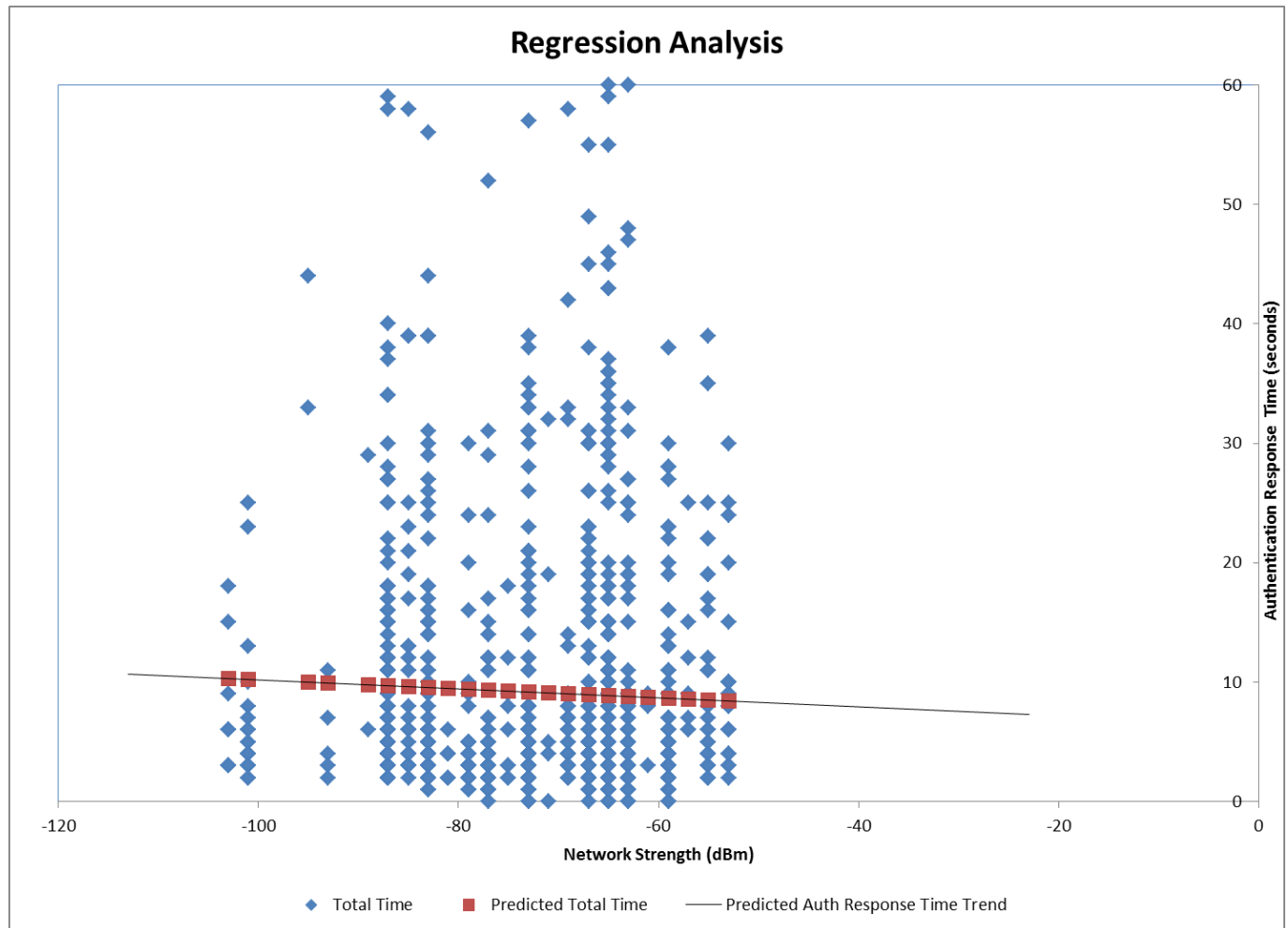


Figure 5: Regression Analysis of Transactions on all three routes

### Approach

1. 1% of all transactions have taken more than 60 seconds to execute therefore they have been treated as outliers and have been excluded from analysis

### Observations:

1. On all three routes very significant variations in network strengths were observed. Network strength varied from -53 (strong) to -111 dBm (weak)
2. “Predicted authentication response time” trend line has negative slope of -0.0372 which indicates that impact of network strength on authentication response time is virtually non-

existent. Moreover, coefficient of correlation between Network Strength and Authentication response time has been calculated as **-0.042** which also indicates almost nil influence.

## 6 Conclusions

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Following conclusions may be derived from the field test

1. Aadhaar biometric authentication has worked successfully in both strong and weak mobile network zones where network strength varied between -53 dBm and -111 dBm.
2. With roaming access available on the SIM, there is no significant impact of weak network strength on authentication response time
3. On a server infrastructure meant for conducting pilot it took approximately 35 seconds to process 95% of all transactions therefore it may be assumed that on production class servers and client applications with superior scalability, retry mechanisms and exception handling better outcome can be expected.

\*\*\*\* End of the Document \*\*\*\*